

# 2014

**Irving K. Barber School of Arts and Sciences**

9<sup>th</sup> Annual Undergraduate Research Conference

Arts & Sciences II, Atrium

11 a.m. to 1 p.m.

Thursday, April 3, 2014

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## Antifungal activity of Lavender essential oils and their constituents on three major agricultural pathogens

**Student: Christopher Bitcon**

**Supervisor: Soheil Mahmoud**

Essential oils of *Lavandula angustifolia*, *Lavandula x intermedia* (Grosso), and *Lavandula provence* (P1) and their components: bisabolol, borneol, camphor, cineole, lavandulol, lavandulol acetate, r-linalool, s-linalol, and linalyl acetate were assayed to assess the antifungal capabilities on three agricultural pathogens. *Botrytis cinerea*, *Mucor piriformis*, and *Penicillium expansum* susceptibility testing was performed using disk diffusion assays. Of the compounds tested, lavandulol, bisabolol, and P1 were the most potent antifungal agents.

## Enhancing Soluble Expression of the Foreign Protein Acetyl coA Ligase in Escherichia coli is Facilitated by Green Fluorescent Protein

**Student: Rajpreet Brar**

**Supervisor: Mary Forrest**

Prokaryotes are frequently used as hosts for expression of foreign proteins. Expression of functionally-active soluble protein often occurs, however sometimes such foreign proteins are packaged into inclusion bodies in a more inaccessible form. These proteins are then more difficult to identify and isolate. Addition of a visible marker, such as the green fluorescent protein (GFP) would make expression easier to follow, and attempts to increase soluble expression easier to interpret. An example of a foreign protein expressed in insoluble form is the acyl-CoA ligase protein from *Streptomyces nodosus* ssp *asukaensis* (Sno). Sno produces asukamycin, a molecule from the manumycin family. Manumycins are a class of secondary metabolites that are notable for their potent antimicrobial, anti-tumour, and anti-inflammatory activities. Asukamycin shows similar such activities except to a weaker degree. Acyl-coA ligase (from the mid1a gene) is involved in building asukamycin, and is of particular interest because its active site interacts with multiple substrates and could be exploited to generate novel bioactive compounds. Previous attempts at expression and isolation of acyl-coA ligase have only yielded insoluble protein. In order to more easily visualize expression, the GFP gene was ligated translationally in-frame with mid1a. To maintain the reading frame an additional base was needed, which resulted in an extra codon. All four nucleotides were tested, however, since expression was similar in all cases, only the GFP-G variant was used for further studies. Attempts at improving soluble expression included varying the concentration of the expression activator IPTG, varying the length of time of expression, and using a protease inhibitor to minimize degradation. The addition of GFP to mid1a allowed for immediate visualization of expressed products, plus easy interpretation of results obtained while working to improve soluble expression. Subsequently, some soluble GFP-mid1a product was isolated from total extracted protein.

## Development of a Ligand-Directed Chemical Ligation of Lysine Residues

**Student: Catherine Collins**

**Supervisor: Frederic Mernard**

The ability to introduce probes which have not been genetically encoded into proteins in their native environment is a challenge in chemical biology. This project focused on the rational design of a probe to label proteins *in vivo* based on the proteins intrinsic structural features. By targeting lysine residues on the surface of a protein for covalent modification, the protein can be labelled with a fluorescent tag. In order to selectively target specific lysine residues, affinity ligands for the protein active site can be used. Since lysine is a latent nucleophile, an electrophilic probe structure was designed and synthesized to effect site-directed, tag-release modification of lysine residues at the surface of a protein. Tag-release modification is important since it allows the affinity ligand to dissociate and thereby return the functionality to the protein. This strategy will allow protein-protein interactions to be monitored post modification using fluorescence imaging. The latest results of the synthetic probes structure and ability to react with lysine residues in a trans-acetylation reaction will be presented. This technique is widely applicable to proteins in biological systems to better understand their roles. Such synthetic probes provide an alternate method to study proteins which does not require the

proteins of interest to be modified genetically.

## **The dark side of negotiation: Examining the nuances of face-to-face and computer-mediated negotiations among dark personalities**

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**Student: Lisa Crossley**

**Supervisor: Michael Woodworth**

Negotiation refers to a decision-making process whereby two or more parties seek to come to an agreement on one or more issues (Carnevale & Pruitt, 1992). They may range in scale from something as small as the purchase of a car on Craigslist, to something as large as a company merger. The role of nonverbal behaviours, such as facial expressions, has been well established as a factor that may influence an individual's success in negotiating in face-to-face contexts (Becker-Stoll et al., 2001). The different factors that are present online, including the lack of nonverbal behaviour, may be important in understanding how individuals succeed in their negotiations. In addition to the situational variables that may affect someone's ability to negotiate, the role of the negotiator's personality also may affect his or her strategizing (Dimotakis et al., 2012). People with specific types of traits, such as those associated with the Dark Triad of personality (i.e., psychopathy, Machiavellianism, and narcissism) have been found to display unique non-verbal behaviours that may influence the manner in which they communicate and are perceived in face-to-face settings, such as a negotiation (Klaver et al., 2009). The current study examined the role of dark traits in buyer-seller negotiations both face-to-face and through computer mediated communication. It was hypothesized that dark personalities would perform significantly better in the face-to-face condition compared to the computer-mediated condition because they were able to rely on their non-verbal behaviour to help them to manipulate, which may make it easier for them to persuade or influence their opponent (Klaver et al., 2009). Additionally, the influence of negotiator role (buyer/seller) was investigated across communication conditions to see whether one's role in the negotiation has any influence on success. Potential implications are discussed for both our understanding of dark personalities, as well as business negotiating.

## **BOARD B**

## **Influence of Emotional Displays and Verbal Apology on Remorse Appraisal**

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**Student: Lauren Currie**

**Supervisor: Stephen Porter**

The ability to accurately detect deception and determine sincerity of emotional expressions is often no better than chance; however, the implications, within the legal system the presence of remorse, specifically, is often relied upon during important legal decisions (ten Brinke & Porter, 2012). Research has found that when individuals show remorse for their actions they are more likely to be forgiven and are judged less harshly by legal system professionals and laypeople alike, arguably motivating offenders to express feigned remorse (Gold & Weiner, 2000). The present study investigated the effect of emotional facial expressions (genuine distress versus feigned high distress versus feigned low distress versus neutral emotional expression) and the verbal components of apologies (victim-directed versus self-directed) on observers' remorse appraisals and other factors related to jury decision-making, including sentencing decisions and estimates of likelihood of recidivism. It was anticipated that observer judgments would be influenced by both emotional expression as well as verbal statements but, more specifically, that observers would provide more lenient sentences for feigned high-distress expressions accompanied by an apology oriented towards victim's distress. A focus on how observers appraise remorse will be important for furthering our understanding of deceptive techniques used by offenders influences sentencing decisions.

**Student: Brittany Derrick**

**Supervisor: Craig Nichol and Mesfin Fentabil**

Limited fresh water resources pose a constraint on the water available for crop irrigation. Few studies have addressed the impact of water-conserving methods on agricultural greenhouse gas (GHG) emissions from woody perennial crops in Canada and elsewhere. New micro-spray and drip irrigation systems are being implemented in orchards and vineyards to conserve water with an unknown effect on soil GHG emission. In this study, fluxes of carbon dioxide and nitrous oxide were measured for different irrigation and fertilization methods to determine average emissions from grapes (*Vitis vinifera* L.; Merlot) planted in sandy loam soil in Summerland, BC, in order to optimize water-use efficiency and minimize GHG emissions. Grape plots were fertilized with 15 grams of nitrogen per vine from 1) urea, 2) urea and pine mulch, 3) compost, or 4) combined pine mulch and compost. All plots had an equal amount of water supplied four times daily by 1) drip or 2) microspray irrigation. Gas samples were collected biweekly over a yearlong period from manual non-steady state chambers that were deployed in grape plots at soil surface. Average flux rates for treatments were assessed for long term trends and cumulative emissions. Preliminary analysis of results suggests that there is little difference in cumulative GHG emissions resulting from drip versus microspray irrigation. Mulch treatments appear to produce the highest emissions of GHG (expressed in carbon dioxide equivalent), largely due to the decomposition of the mulch itself. The results from this study will contribute to a larger research project that is examining net GHG emissions, carbon cycling and microbial activity in order to recommend agricultural practices that reduce water-use and greenhouse gas emissions.

## Steric effects and photolysis in chromium-catalyzed carbon-carbon bond forming reactions

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**Student: Laura Fairburn**

**Supervisor: Kevin Smith**

Synthesis of pharmaceuticals and materials relies heavily on transition metal cross-coupling catalysts. While palladium remains the most popular metal for these carbon-carbon bond-forming reactions, there has been increasing research on replacing Pd with more earth-abundant first row metals. For cross-coupling reactions involving iron, cobalt and nickel catalyst, N-heterocyclic carbene (NHC) ligands have been proven to be effective. Previously, the Smith group has studied well-defined chromium complexes with small NHC ligands. While their relatively strong Cr-NHC bonds aided in the isolation of these compounds, intense light was required to induce activity for catalytic C-C bond forming reactions. This poster will focus on chromium catalysts using larger NHC ligands with weaker Cr-NHC bonds, including N-heterocyclic carbenes with unsymmetric substituents. Not only do these catalytic C-C bond forming reactions proceed in the absence of intense light, improved yields are observed when the reactions are protected from the ambient light in the lab. Understanding the connection between sterics, photolysis, Cr-NHC bond strengths and catalytic efficiency in homocoupling reactions will help guide further research for the rational design of chromium-based cross-coupling catalysts.

## Hostile Versus Friendly Complementarity: An Examination of Stability, Evaluations, and Task Performance in Dyads

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**Student: Kelsey Frankiw**

**Supervisor: Brian O'Connor**

Interpersonal complementarity exists when individuals who have corresponding interpersonal styles elicit predictable responses from each other. Complementary interactions are assumed to result in higher levels of felt security, relationship satisfaction, and task performance. The purpose of our study was to determine if these benefits also occur in couples who are high on hostile complementarity. Are the romantic relationships of pairs of hostile persons stable? Are such relationships satisfying? And do such couples perform well on cooperative tasks? Or are the benefits of complementarity restricted to dyads that are high on friendly rather than hostile complementarity? The findings will hopefully provide a better understanding of what occurs when hostile individuals are involved in close relationships with other hostile individuals.

## Identification of omega-6 polyunsaturated fatty acid induced mechanisms of insulin resistance and mitochondrial dysfunction in liver

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**Student: Samantha Gottfred**

**Supervisor: Sanjoy Ghosh**

In 2030, it is estimated that 366 million people world-wide will be living with diabetes, the majority of whom will have type 2 diabetes (T2D). Hepatic insulin resistance is a characteristic feature and cause of T2D. In recent years, the North American diet has seen a sizable increase in consumption of unsaturated fats such as omega-6 polyunsaturated fatty acids (n-6 PUFA) and monounsaturated fats (MUFA), which can elevate intracellular lipids, damage mitochondria and impair hepatic insulin signalling. To evaluate the hepatic effects induced by these fatty acids, C57Bl/6 mice were fed a diet rich in n-6 PUFA (from corn oil), MUFA (from olive oil), a balance of n-6 PUFA and MUFA (from canola oil), or a low fat chow diet for 5 weeks. Liver tissue from these mice was then isolated and glycogen content was analyzed. Liver glycogen content of n-6 PUFA-fed mice was significantly reduced compared to MUFA-fed mice, indicating breakdown of liver glycogen, a hallmark of hepatic insulin resistance and impaired insulin signalling. To confirm the associations between major fatty acids and their impact on insulin signalling, AML12 mouse liver cells were incubated with linoleic acid (LA; major n-6 PUFA) and oleic acid (OA; major MUFA) *in vitro*. LA, but not OA, significantly reduced mitochondrial respiratory capacity. LA also reduced Akt protein expression and phosphorylation status in AML12 cells, which is crucial for hepatic insulin signalling. The results indicate a direct impact of n-6 PUFA on the development of mitochondrial respiratory impairment and insulin resistance both *in vivo* and *in vitro*. These results could provide important clues to elucidate the molecular basis for the rise in insulin resistance and T2D in populations consuming a high n-6 PUFA diet.

## The Effects of DHA Supplementation to Infant Formula and Breast Milk on The Infant's Developing Gut Microbiota

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**Student: Michael Jay**

**Supervisor: Deanna Gibson**

The addition of  $\omega$ -3 polyunsaturated fatty acids (PUFA), such as docosahexaenoic acid (DHA), to North American diets, specifically baby formula and breast milk, has been a recent development in the last thirty years. The popular media has characterized DHA supplementation as having beneficial effects on health, particularly emphasizing improvements in normal brain functioning. A recent meta-analysis looked at the effects of DHA supplementation to breast milk and found positive impacts on a variety of health criteria in newborns. However a meta-analysis conducted by Zahra Ahmadi and Dr. Jason Loepky of UBC Okanagan, looking at multiple health parameters showed no beneficial effects of DHA supplementation to infant formula. These two studies in addition to preliminary work done by the Gibson Laboratory have created a need to characterize the normal gut microbial composition in infants and how different diets, with or without DHA supplementation, can affect the normal gut microbiota. A clinical research ethics application for the collection and analysis of stool from newborn infants aged 0-6 months within the Okanagan Valley was submitted and accepted through the Clinical Research Ethics Board at UBC Vancouver. Various strategies were used over the year to recruit mothers to donate their infant's stool, including the use of poster and pamphlet advertisements, medical clinics in Kelowna, privately-run trade shows, and the use of social media websites. Following sample collections, stool microbiota community structures were examined using DNA extraction followed by qPCR to determine the taxonomical identities and relative abundances. Collection techniques were validated by success in lab analyses. The preliminary results of this study indicate that DHA supplemented formula does impact the infant gut microbiota compared to breastfed infants and that the gut microbiota of breastfed infants mimics that of a healthy newborn.

## Finding Meaning in Languages: Sense of Place in the Linguistic Landscape of Bernard Avenue, Kelowna

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**Student: David Lacho**

**Supervisor: Christine Schreyer**

The study of linguistic landscapes focuses on the language found on signs and placenames (Landry and Bourhis 1997). My research involved conducting an online and in-person survey to reveal how residents of Kelowna experience language on Bernard Ave, the “main-street” of the city. Kelowna’s downtown is currently undergoing a \$14-million urban revitalization, deemed an “identity-establishing project” (City of Kelowna). Part of this project involves a reconfiguration of the linguistic landscape of Bernard Ave. For example, plaques written in Nsyilxcn, the language of the Okanagan Nation, have been placed on sidewalks. In this research poster, I describe how residents of Kelowna rely on personal memory of similar linguistic landscapes to construct their own understanding of the linguistic landscape of Kelowna.

The first phase of this research comprised a walkthrough of the linguistic landscape, which involved photographing and documenting the location of various signs and their corresponding language(s) on Bernard Ave. I analyzed and quantified the data from the walkthrough to understand the ways in which language choice and visibility on street signs could convey linguistic and/or ethnic identity. The second phase of my research involved the use of both an on-line and in-person survey to understand the linguistic landscape. The survey included a photo of each of the languages from the initial walkthrough of Bernard Avenue and asked participants to identify the language. Also, it asked respondents to relate the signs to a sign they had seen elsewhere.

Previous studies in this field have neglected to incorporate the ways in which an individual’s memory contributes to the construction of linguistic landscapes. In future, the combination of methods used in my research could contribute to a richer understanding of the ways in which people create meaning and perceive their linguistic landscapes, as well as create sense of place.

## Oxidative Stress, DNA Damage And Lifespan In Response to Dietary Fats In *Drosophila Melanogaster*

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**Student: Justine Lambert**

**Supervisor: Sanjoy Ghosh**

Current Western diets contain large amounts of polyunsaturated fatty acids (PUFA), mostly n-6 PUFA and monounsaturated fatty acids (MUFA). It is well known that excess fatty acids increases cellular and DNA damage due to the generation of reactive oxygen species (ROS), during fat metabolism in mammals. While such fatty acids are required as an essential nutrients in mammals, it is not required for development and growth in lower organisms such as flies. We hypothesized that besides acting as a nutrient, various fats due to differences in their chemical structure could differentially alter susceptibility to DNA damage, ROS generation and survival in the model fly species *Drosophila melanogaster*. Male flies were reared on food containing 0%, 0.5% or 1% fat mixture (equal parts olive oil (MUFA), corn oil (n-6 PUFA) and coconut oil (saturated)). Newly formed adults male flies were then gathered and placed on diets containing higher concentrations of either olive, corn, or coconut oils. Significant differences in survivorship between the flies fed various high fat diets indicated that different fats do affect survivability in flies akin to mammals. To see if the increased mortality was due to DNA damage, expression of DNA repair enzymes was quantified using qPCR. Analysis was performed on pooled groups of whole flies to identify variations in expression of *ogg1*, *rad50*, *rad51*, and *xrcc1* genes involved in DNA repair. Preliminary results from this ongoing research indicate that like mammals, ROS generation in flies are also differentially affected by which fatty acid is consumed postnatally. This research represents an important step towards establishing fatty acids as a fundamental cause for DNA damage and ROS production even in lower organisms, independent of their metabolic needs.

## Energy and Conformation of Glycinate on a Cu(110) Surface

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**Student: Tommy Lee**

**Supervisor: David Jack**

Glycine adsorbed on the Cu(110) surface prefers to assemble into heterochiral domains rather than homochiral domains for the temperature range between 300 and 406 K. To understand the mechanism of adsorption and surface diffusion, the energy and geometry of glycine molecules chemically adsorbed on a copper surface in the glycinate form were studied computationally. In particular the difference in energy and structure of a molecule standing vertical to the surface and parallel to the surface was calculated and contrasted to determine the most stable orientation of the glycinate. In addition, intermediate structures were also calculated to obtain the energy barrier between these two extreme configurations. This energy barrier is thought to be the barrier that energetically separates the heterochiral and homochiral domains. Calculations were performed using the computer program GAMESS using density functional theory (DFT) with SKBJC type pseudopotentials for the copper atoms. The copper atoms were assumed to be fixed in position for all calculations.

## Characterization of the Putative Copper Uptake Transporter CTR1D from the Yellow Fever Mosquito *Aedes aegypti*

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**Student: Kim Lemky**

**Supervisor: Mark Rheault**

Copper is an essential trace dietary element required for growth, development and various metabolic functions in all living organisms. However, levels of copper must be maintained within a strict window of essentiality to prevent toxic effects. Copper uptake from dietary sources is thought to be mediated by various copper uptake transporters. Recently our lab has isolated cDNA encoding for a number of putative copper transporters from the aquatic larvae of the yellow fever mosquito, *Aedes aegypti*. Gene expression analysis using quantitative PCR showed that the putative copper uptake transporter *crt1d* was increased in the malpighian tubules (kidneys), hindgut, and anal papillae after exposure to environmental copper. In order to further characterize the function of the putative copper transporter we cloned *crt1d* in to the dual mammalian cell/*Xenopus laevis* oocytes expression vector pXOON. Complimentary RNA (cRNA) was generated from our engineered molecular construct and injected into *Xenopus* oocytes to ascertain functional characterization. The transport of copper by CTR1D expressing oocytes was measured using Inductively Coupled Plasma Mass Spectrometry (ICP-MS).

## A computational analysis on the electronic structure of the carbon-cobalt bond in adenosylcobalamin.

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**Student: Satinder Lidher**

**Supervisor: David Jack**

Previous crystallographic data has shown an unusually stable cobalt-carbon (Co-C) bond in the enzymatic cofactor adenosylcobalamin when incorporated into the enzyme D-ornithine 4,5-aminomutase (OAM). Interestingly, each of the four sites within the crystallographic subunit have varying Co-C bond lengths, showing progressive elongation of the Co-C bond, with a possible ruptured bond. The purpose of this study is to investigate the stability of the Co-C bond through comparisons of the electronic structures in each of the four sites and calculations of electronic charge distribution within the cofactor. The adenosylcobalamin was modelled using the coordinates extracted from the x-ray data of OAM in the base-off conformation which includes a histidine residue as a lower-axial ligand, creating a cobalt-nitrogen (Co-N) "bond" opposite to the Co-C bond. In comparing the structures of the four different cofactors, it was found that there are only slight changes seen in the corrin ring and the histidine. However, the orientation of a hydroxyl group on the pyridine ring of the adenosyl moiety differs in two structures with the intermediate Co-C bond, as compared to those of the intact and elongated Co-C bonds. This indicates an important electrostatic interaction with the protein environment that may be involved in the progression to an elongated, or even ruptured, Co-C bond. A qualitative analysis will be done for further insight on this interaction. In addition, the Co-N "bond" was shown to decrease in length

as the length of the Co-C bond elongates. Forth coming energy calculations, using the computational software GAMESS, will be used to quantify the unusual intact, or possible ruptured, Co-C bond.

## H2 Adsorption on Crystalline MgO Surfaces: The Effect of Quantum Mechanical Rotational State on Unit Cell Structure.

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**Student: Christina Livingstone**

**Supervisor: David Jack**

Hydrogen molecules (H<sub>2</sub>) that adsorb on crystalline surfaces at low coverage ( $\theta < 1$ ) and temperatures ( $T < 20$  K) form repeating nanostructures (unit cells). Due to the atomic scale nature of these systems, specific structural details may only be determined with computer-simulated models with accurate interaction potential between H<sub>2</sub> molecules. Previous investigators have developed an H<sub>2</sub>-H<sub>2</sub> interaction potential based on *ab initio* quantum mechanical energy calculations. In the present study, this interaction potential was quantum mechanically averaged over the rotational state of the H<sub>2</sub> molecules and then used in a Monte Carlo (MC) simulation of a layer of H<sub>2</sub> molecules adsorbed on a magnesium oxide (MgO) surface. The MC simulation was run using the Metropolis method in the canonical ensemble (N, V, T). Although the H<sub>2</sub> molecules were allowed to freely translate and change their orientation, the Mg<sup>2+</sup> and O<sup>2-</sup> ions of the surface were fixed in position. The average position and orientations of the H<sub>2</sub> molecules were determined and compared for two different coverages (50%,  $\theta = 0.5$  and 75%,  $\theta = 0.75$ ). The incorporation of rotational state *J* in the interaction potential was important in the correct reproduction of experimental results. This work sets the stage for accurate simulation of multiple layers of H<sub>2</sub> molecules on crystalline surfaces, and for application to different surface-adsorbate systems.

**BOARD E**

## Water Soluble Cobalt Catalysts for Lignin Model Degradation

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**Student: Kristina Malekow**

**Supervisor: Stephen McNeil**

The use of non-renewable petroleum resources for energy and materials is becoming less economically feasible as increasingly more remote hydrocarbon deposits are explored. By switching the feedstock for industrial chemical synthesis to a more renewable one, these stresses can be mitigated. The pulp and paper industry provides such a source, in the form of the natural waste product, lignin. The use of lignin, a complex biopolymer, as a feedstock is dependent on the development of a catalytic system to degrade it. Preliminary studies have shown promising results using cobalt complexes for the degradation of small organic molecules that model key reactive sites of lignin polymers. Exploratory studies using cobalt salen complexes were impeded by lack of solubility of the cobalt catalysts, encouraging studies with the following similar, but water soluble complexes. Soluble cobalt salen derivatives were prepared by electrophilic aromatic substitution of sulfonyl groups onto the periphery of the ligand groups surrounding the cobalt atom. These complexes were then examined for their ability to catalyse the oxidation of veratryl alcohol, a monomer model for the benzylic alcohol groups common in lignin polymers. Various reaction conditions, such as pH, temperature, and nature and concentration of oxidant were adjusted. Results of these experiments will be presented, along with the synthetic methods to the soluble cobalt catalysts.

## **An Agent Based Model of Black Bear Movement and Human Interactions: Is teaching an efficient method to reduce the frequency of human bear conflicts?**

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**Student: Jessa Marley and Joe Salked**

**Supervisor: Lael Parrott and Rebecca Tyson**

In British Columbia, interactions between humans and black bears are frequent where humans have invaded bear habitat. When humans and bears cross paths there is a high risk for both the animal and the people. Bears learn that human waste and products are a good source of food and then continually return. In order to reduce the number of bears that enter human settlements, the bears are usually aversely conditioned, translocated or exterminated. The loss of bear life is a conservation concern. One possible approach to this problem is to educate the public to increase bear awareness and improve property management. Using an agent-based model that simulates a bear's foraging in an area that includes urban and rural sections, we can test the impact of bear awareness education. The model can be used to keep track of the numbers of bears that are continually attracted to human populations, that learn to avoid humans or that never encounter people, in the absence of bear awareness education. With education included, the changes in these statistics are observed. In particular, with the model the distribution of educated people can be controlled, and its effect on the number of human bear interactions can be investigated. The model can then be expanded to multiple bears, to create a more realistic environment. The results gathered so far support effectiveness of this education and indicate some distributions lead to fewer conflict situations than others.

## **The relationship between eating disorder traits and semantic bias: A lexical decision study**

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**Student: Kaylee Misener**

**Supervisor: Maya Libben**

Eating disorders are characterized by negative cognitive biases towards body shape and food (Williamson et al., 1999). Self-report measures are largely ineffective in assessing these biases due to the prevalence of dishonesty and symptom minimization among eating disordered individuals (Allen et al., 2011). Here we aim to develop a new method of objectively evaluating negative food and body shape biases using a behavioural reaction time paradigm. 130 female undergraduate participants (ages 18-25) participated in a lexical decision task in which they viewed word pairs and made a word/non-word judgment to the second string of letters (i.e. the target). Prime words either biased the negative interpretation of the target (e.g. fat-pizza), the positive interpretation (e.g. party-pizza) or were unrelated (e.g. boot-pizza). Participants then completed five eating disorder questionnaires. We predicted that participants who scored higher for eating disordered traits would show faster lexical decision times to negatively primed targets as compared to participants who scored lower on eating disordered traits. We found a positive correlation between the magnitude of negative priming effects and scores on four of the five administered eating disorder questionnaires. This research may help in future eating disorder assessments. Further research could elucidate the differences between groups of participants who are symptomatic and post-symptomatic of eating disorders.

## **High? Social Anxiety and Cannabis Use**

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**Student: Christel Mitchell**

**Supervisor: Marvin Krank**

Social anxiety is one of the most common anxiety disorders, with a lifetime prevalence rate of 12%. Similar prevalence rates are found among university students. Social anxiety disorder (SAD) is a very persistent disorder and is more common in women than men. SAD is frequently associated with high rates of cannabis abuse and dependence. This is a cause for concern because cannabis use tends to make the already significant problems of individuals with SAD more severe and complex. This study investigated the relationship between the frequency of cannabis use and SAD as well as cannabis use motivates among university students with SAD. There were 225 participants (female=161, male=64) in this study, who ranged from 17 to 50 years old. 56% of both females and males had used cannabis, of those who had used cannabis 29.7% of the males and 11.2% of the females reported that they had used cannabis in the last week. This study did not find a significant relationship between SAD and frequency of cannabis use but SAD was found to be associated with the conformity motive. Understanding what motives individuals with SAD to use cannabis is important for both prevention and treatment.

## Neurosteroid Regulation of Neurogenesis in the Adult Brain

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**Student: Rebecca Mlikotic**

**Supervisor: Bruce Mathieson**

Neurogenesis is the process by which new neurons and neuroglial cells are generated from stem cell populations within the central nervous system. Brains show high levels of neurogenesis activity during embryonic development, but in mammalian animals, neurogenesis is severely restricted in the adult. For unknown reasons, teleost fish maintain high levels of neurogenesis throughout their adult lifetime. Recent evidence has implicated a class of endogenous steroid-like compounds, called neurosteroids, in the regulation of neurogenesis. However, until now no research has examined whether neurosteroids are responsible for the high levels of neurogenesis observed in the adult fish. Here, we use a goldfish model to analyze the effect of the neurosteroid allopregnanolone (ALLO), which has been shown previously to promote mammalian neurogenesis. Three treatments were given to adult goldfish to manipulate the amount of ALLO present in the brain: a control group with no change in endogenous levels of ALLO; a second group whose synthesis of ALLO was blocked by finasteride, an inhibitor of the enzyme that synthesizes ALLO; and a third group that received an injection of ALLO to raise brain concentrations above endogenous levels. The effects of these treatments on numbers of newborn neurons were measured using a confocal microscope and immunocytochemical labelling of neurons undergoing cell division (neurogenesis). The dorsal-medial cerebellum was specifically analyzed because numerous labelled neurons were visible in that region. The results of this study will increase our understanding of the central mechanisms of brain growth and repair throughout development. This understanding has potential benefits in developing clinical strategies following brain or spinal cord injury, whereby neurogenesis may be promoted and damaged neurons replaced with healthy new neurons.

## The Impact of Alcohol and Marijuana Use on Adolescence Health

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**Student: Lisa Ohlhauser**

**Supervisor: Marvin Krank**

The negative health effects of using alcohol and illicit drugs are well documented. These effects are especially harmful to the health of adolescents, who are undergoing a critical period of brain development. However, the specific patterns of substance use are not well investigated. Data from the Project on Adolescent Trajectories on Health (PATH), a longitudinal study on risk-taking in adolescence, were analyzed to better understand the consequences of patterns of alcohol and marijuana use on adolescent health. PATH was a three year longitudinal study that surveyed Okanagan students (N=956) annually for three years, starting with students in grade seven, eight, and nine. Substance use behaviours and symptoms of poor health were the primary variables included in the analyses. Results from a Univariate Analysis of Variance (ANOVA) reveal significant differences in overall health between three groups of adolescents: (1) those who reported no drug use, (2) those who reported using alcohol in the past month, and (3) those who reported using both alcohol and marijuana in the past month,  $F(2, 427)=4.96, p=.007$ , partial eta squared=.023. Results from Multivariate Analysis of Variance (MANOVA) show significant multivariate main effects for both recency of alcohol use; Wilk's  $\Lambda = .935, F(12, 2357.656)=.773, p>.001$ , partial eta squared = .022, observed power =1.000, and recency of marijuana use; Wilk's  $\Lambda = .956, F(12, 2352.364)=3.337, p>.001$ , partial eta squared = .015, observed power =.992. Gender effects, the impact of specific patterns of substance use on poorer health symptoms, and the direction of the relationship between substance use and poor health symptoms will be discussed. These findings suggest there are negative health consequences of using substances during adolescence, especially for the use of alcohol.

**Student: Marisa Okana**

**Supervisor: Zachary Walsh**

Intimate Partner Violence (IPV) is a prevalent public health concern and identifying factors that are associated with risk for IPV is a research priority. Individuals with a history of IPV victimization have been found to be at increased risk of victimization in subsequent relationships (O'Keefe & Treister, 1998). However, the factors that underlie this increased risk are poorly understood, and few studies have examined the extent to which individuals with and without history of IPV differ with regard to the evaluation of potential intimate partners. The present study examines differences between women with and without histories of IPV victimization with regard to attractiveness ratings of real and hypothetical men who vary on traits related to risk for IPV perpetration (i.e. psychopathic personality). Participant history of IPV was assessed using the Conflict Tactics Scales (CTS2; Straus, Hamby, Boney-McCoy, & Sugarman, 1996), a widely used measure of intimate partner violence. Participants rated potential partners according to attractiveness and willingness to engage in a hypothetical romantic relationship based on two presentation contexts: brief video clips of maximum-security inmates previously evaluated for psychopathy, and two completed questionnaires designed to assess psychopathic personality, one of which was suggestive of high psychopathy and the other was suggestive of low psychopathy. Preliminary results indicate that females with a history of partner violence victimization reported more attraction in general, and men with higher levels of psychopathy were rated to be generally more attractive. The effects of victimization history and psychopathy were independent, not interactive.

## Water-Soluble Polyamine Cobalt and Iron Complexes for Catalytic Oxidation of Lignin Model Compounds

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**Student: Sarah Parke**

**Supervisor: Stephen McNeil**

There is ongoing effort to develop methods to generate chemicals and sources of energy from renewable resources. Lignin, a naturally-occurring polymer comprising highly cross-linked carbon ring structures, imparts rigidity to cell walls of plants. Lignin is produced in large quantities by the pulp, paper, and lumber industries but most of it is burned as a low value fuel. If lignin could be broken down to release its smaller subunits, this would provide a renewable source of many organic chemicals currently obtained from petroleum.

The reactivity of metal atoms can be altered by changing the structure of the organic compounds surrounding and binding to the metal center. Thus far, the most commonly studied cobalt-containing lignin oxidation catalysts are those with four atoms arranged in a plane around the metal. There has been less focus on cobalt catalysts with trigonal bipyramidal geometry, (three atoms in a plane surrounding the metal with additional atoms along an orthogonal axis) for the purposes of lignin oxidation. We have prepared a series of trigonal bipyramidal iron and cobalt complexes with the ligand tris(2-N,N-dimethylaminoethyl)amine ( $\text{Me}_6\text{tren}$ ), to test for catalytic activity in the oxidation of lignin model compounds. These complexes include the previously synthesized  $[\text{Co}(\text{Me}_6\text{tren})\text{Cl}]\text{Cl}\cdot x\text{H}_2\text{O}$ ,  $[\text{Fe}(\text{Me}_6\text{tren})\text{OTf}]\text{OTf}$ , and  $[\text{Fe}(\text{Me}_6\text{tren})\text{Br}]\text{Br}$ , as well as the previously unreported  $[\text{Co}(\text{Me}_6\text{tren})\text{NO}_3]\text{NO}_3$ ,  $[\text{Co}(\text{Me}_6\text{tren})\text{OTf}]\text{OTf}$ , and  $[\text{Fe}(\text{Me}_6\text{tren})\text{OAc}]\text{OAc}$  (OTf = triflate,  $\text{OSO}_2\text{CF}_3$ , OAc = acetate,  $\text{O}_2\text{CCH}_3$ ).

UV-visible absorption spectroscopy was used to monitor the interaction between the metal complexes and oxygen, hydrogen peroxide, and veratryl alcohol, a compound that can serve as a model for target sites of reactivity in lignin. The catalytic activity for the oxidation of veratryl alcohol was tested using water as the reaction solvent and  $^1\text{H}$ NMR as a means of monitoring substrate degradation and product formation. Results regarding the efficiency of the various catalysts will be presented and discussed.

## Risky Behaviour: What were you thinking?

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**Student: Christine Rogers**

**Supervisor: Marvin Krank**

The purpose of our study was to examine the role of Future Orientation (FO) in explaining alcohol-related cognitions and overall alcohol use in a university sample. Our research extends previous findings on FO by emphasizing the cognitive aspects of alcohol use and how these relate to future oriented thought. This study contributes to previous research by further exploring the factor structure of FO, as well as by investigating the relationship between individual factors of FO and alcohol use. 300 students from a university population were examined on two levels of alcohol-related cognitions; Outcome Expectancy Liking Scale (AOEL) and Word Homographs (or ambiguous word associations; AW) as well as their own current alcohol use and level of future oriented thought. Using exploratory factor analysis (EFA) procedures, we established a three-factor model for FO which indicates FO is a multidimensional construct. Further analysis examined the relationship between degree of future orientation and level of substance use. The relationship between alcohol-related cognitions and FO contributes to our understanding of the factors that influence initiation and maintenance of alcohol use in young adults. Targeting and training future oriented thought within an age group that is highly susceptible to alcohol use may offer a unique and effective approach for prevention programs thus reducing alcohol use and its related consequences.

## Ore minerals and alteration minerals of the Copper Mountain Mine

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**Student: Kristi Silk**

**Supervisor: Yuan Chen**

The porphyry copper-gold deposit of the Copper Mountain Mine is located 15km south of the town of Princeton, British Columbia, in the Quesnel Terrane. The Late Triassic Nicola Group andesitic volcanic and sedimentary rocks were intruded by diorite to monzonite magma during the Jurassic period. Hornfels metamorphism and pervasive hydrothermal alterations occurred following the magmatic intrusion. The hydrothermal alterations include sodic, potassic, sericite, chlorite, actinolite, epidote, kaolinite and carbonate minerals. The copper-gold mineralization is either pervasive or structurally controlled as veins or stringers and disseminations. The ore minerals are predominantly chalcopyrite and bornite, with minor other sulfide minerals.

A petrographic study of ore minerals was conducted for six polished thin sections. Mineral chemistry of ore minerals and select alteration minerals was analyzed using a scanning electron microscope in the UBC Okanagan SEM Lab. Grains of gold were found in one thin section. Three of the grains were electrum (Ag > 21.0 wt%) and two were native gold (Ag < 21.0 wt%). Traces of silver were found in tetrahedrite grains in the same thin section. Galena was also found in two of the thin sections. Sulphide minerals studied include chalcopyrite, bornite and pyrite. Magnetite was the most abundant oxide. Alteration minerals were silicates including quartz, chlorite, biotite, feldspars and actinolite, and carbonates. The results of this analysis contribute to understanding ore-forming processes.

## Effects of Host Nitrogen Status on Nitrogen Distribution by the Fungus in a Common Mycorrhizal Network

**Student: Joshua Smith**

**Supervisor: Melanie Jones and Matthew Whiteside**

The boreal forest is the world's largest terrestrial biome, constituting 25% of the world's forest canopy. This ecosystem is predominantly characterized by nitrogen-limited, climax gymnosperm forests in symbiosis with ectomycorrhizal fungi. These fungal symbionts have the capability of forming mutualistic associations with root systems of more than a single host simultaneously. While most research has examined mycorrhizal dynamics in a single host, single fungus environment, little is known about how a single fungus allocates nutrients to multiple host plants. To test the hypothesis that these fungi will differentially allocate nutrients in response to host demand, we created ectomycorrhizal common mycelial networks, consisting of an ectomycorrhizal fungus, *Suillus tomentosus*, in symbiosis with two pine (*Pinus contorta*) seedlings. After the mycorrhizas were formed, 4.7 mM NH<sub>4</sub>Cl was applied to the foliage of one of the *P. contorta* seedlings in each pair. The only other nitrogen source in the microcosms was a well that was only accessible to the hyphae. This ensured that the only route of nitrogen acquisition for the roots was via the fungus. To quantify the differential allocation of nitrogen to the seedlings, the media in the well was labelled with <sup>15</sup>N-enriched nitrogen, in both organic form, predominant in boreal soils, or inorganic form, less prevalent in boreal soils. The relative allocation of fungal nitrogen will be calculated to determine whether the fungus partitions nitrogen differentially to the two hosts. Currently, samples are still being processed at the isotope laboratory at UC Davis in California. We hypothesise that the seedlings that received foliar nitrogen will receive a reduced proportion of nitrogen from the ectomycorrhizal fungi, relative to the other seedling in the common mycelial network. The results of this experiment will further our understanding of nitrogen biogeochemical cycles in boreal ecosystems and has applications to climate change and conservation research.

## Single Electron Transfer Reactions of Chromium Complexes with Organic Halides and Esters

**Student: Thomas Welsh**

**Supervisor: Kevin Smith**

The research group of Dr. Kevin Smith is focused on the synthesis and reactivity of organometallic chromium complexes for carbon-carbon bond formation catalysis via single electron redox mechanisms. Chromium, a first row transition metal, offers an attractive alternative to more expensive transition metal catalysts. Chromium's two readily available oxidative states, Cr(II) and Cr(III), with the help of tunable ancillary ligands, allow chromium complexes to control the reactivity of carbon-based radicals to form new carbon-carbon bonds. The Smith group has previously studied well defined high spin chromium(II) complexes of the form CpCr((ArNCMe)<sub>2</sub>CH) and Cr((OC<sup>t</sup>Bu)<sub>2</sub>CH)<sub>2</sub>(bpy). The first complex was shown to react with organic halides in a single electron oxidative addition that is believed to occur via an inner sphere halogen atom abstraction, which yields a Cr(III) halide complex and an organic radical. With the second complex, the Smith group has recently shown that it reacts with Ph<sub>3</sub>CBr to form cationic [Cr((OC<sup>t</sup>Bu)<sub>2</sub>CH)<sub>2</sub>(bpy)]<sup>+</sup> and trityl radical. This reaction is believed to occur via an outer sphere mechanism involving the bipyridine ligand-based radical. In this project, the reactivity differences between Cr(LX)<sub>2</sub> and neutral Cr(LX)<sub>2</sub>(bpy) complexes, where LX is a bidentate, monoanionic ligand, are explored by reacting these complexes with both CpCr((ArNCMe)<sub>2</sub>CH)(X) and R-X substrates, where X is a halide or carboxylate. The LX ligands studied include [(OC<sup>t</sup>Bu)<sub>2</sub>CH]<sup>-</sup> and [C<sub>6</sub>H<sub>4</sub>CH<sub>2</sub>NMe<sub>2</sub>]<sup>-</sup>, and four coordinate square planar Cr (II) complexes with these ligands exhibit similar reactivity patterns when reacted with organic substrates. In particular, the differences in reactivity between Cr(LX)<sub>2</sub> and Cr(LX)<sub>2</sub>(bpy) are much more significant. The primary analytical tool employed to study these complexes and monitor their reactions is ultraviolet-visible spectroscopy, as many of these complexes absorb very strongly in the visible range. By studying these Cr complexes, it is hoped that new catalytic mechanisms for carbon-carbon bond formation can be discovered.

## Groundwater – Surface Water Interaction: Determination of groundwater recharge over the alluvial fan of Mill Creek.

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**Student: Jordan Wu**

**Supervisor: Craig Nichol**

Increasing pressures on water resources can be caused by climate change, land use changes, and population growth. Efforts have been made to quantitatively understand water use and supply in the Okanagan Valley to help plan future water availability for the region. Improvements on groundwater information, especially data on groundwater and surface water exchanges in the Okanagan, could better our predictions of the region's water supply. This project quantified the amount of groundwater recharge from a surface water body (Mill Creek) during the winter season using differential stream gauging, streambed temperature profiles and subsequent modeling using coupled heat and groundwater flow software (VS2DHI). Initial differential stream flow measurements showed that Mill Creek could be losing approximately  $0.014 \text{ m}^3/\text{s}$  to groundwater over the alluvial fan. A thermal monitoring station was installed at one accessible location to monitor the temperature profile at 10, 30, 50 and 100 cm below the streambed. Using specified boundary conditions and initial measured streambed temperatures, a groundwater flux ( $q$ ) of  $3.0$  to  $5.0 \times 10^{-7} \text{ m/s}$  was determined. This flux produced the best-fit temperatures relative to the measured temperatures (i.e. lowest root mean square error) modeled. This study demonstrates that the use of heat for tracing groundwater recharge is relatively simple and could be useful for improving groundwater data at other similar recharge locations. The data will help improve our understanding of the Okanagan's water resources.